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10/540906

JC20 Rec'd PCT/PTO 29 JUN 2005

TH/bs 011290WO
28. Juni 2005

FILLING MACHINE AND METHOD FOR FILLING FOODSTUFFS

The present invention relates to a filling machine and a method for filling foodstuffs, particularly beverages, in composite packages which are open on top, and for sealing these packages, using a packaging transport device, a sterilization unit, a drying unit, a filling unit, and a sealing unit.

Such filling machines are known in various embodiments from practice. Normally, the individual units connected in series are typically positioned above the composite packages in a line, the manufacturing being performed in multiple parallel lines. In the known facilities, the composite packages open on top are produced from a packaging sleeve immediately before the sterilization. Since the production of the composite packages is performed on an intermittently rotated mandrel wheel, the speed of linear transport is directly dependent on the output speed of the mandrel wheel. It is immediately obvious that the transport speed may not be elevated arbitrarily, since the linearly transported composite packages open on top must be filled from fixed filling nozzles. With linear transport of the composite packages to be filled and fixed filling nozzles, for optimization of the output speed, the actual filling process must be performed in a relatively short time, which leads to undesired foaming on the liquid.

The present invention is therefore based on the object of implementing and refining a filling machine of the type initially cited and described in greater detail above in such a way that - at the same output - more time may be made available for the individual processes (sterilization, filling, and sealing process), particularly to prevent the undesired foaming.

This object is achieved in that multiple assemblies, made of a sterilization unit, a drying unit, and a filling unit, which are assembled into processing lines, are firmly positioned on a rotating rotary machine and the transport direction of the composite packages on the rotary machine runs radially around the axis of rotation.

According to a preferred teaching of the present invention, the rotary machine is rotated continuously around the axis of rotation in this case.

A further teaching of the present invention provides that the transport of the composite packages in the radial direction occurs in the radial direction each on a plurality of traveling feeders corresponding to the number of the assembly rows. A fixed support rail is expediently used as the control element for the floor guides of the composite packages is positioned below the rotating rotary machine. This fixed support rail preferably has at least one recess for the discharge of the filled and possibly sealed composite packages.

According to a further preferred embodiment of the present invention, the composite packages positioned on

the rotating rotary machine and/or the individual units or assemblies are situated displaceably in relation to one another in the vertical direction. The composite packages positioned on the rotating rotary machine are alternatively or additionally displaceable in the radial direction in relation to one another. The relative motion expediently occurs via a curve controller.

A further teaching of the present invention provides that the rotating rotary machine is sealed in relation to the atmosphere except for the openings for the inward (charging) and/or outward (discharging) transfer of the composite packages.

According to the present invention, it is possible that multiple sealing units are provided on the rotary machine. For this first embodiment of the present invention, the composite packages are transferred into the rotary machine from the outside, moved there radially toward the axis of rotation via its peripheral motion, and filled and sealed thereby. The outward transfer is then expediently performed vertically downward.

An alternative embodiment of the present invention provides that multiple sealing units are provided outside the rotating rotary machine. For this alternative embodiment, the sealing units are preferably positioned in a housing, shaped like an annular segment, outside the rotary machine housing, which is rotatable by a preset angle around the axis of rotation and in relation to the rotary machine.

Both embodiments expediently have sealing units which are implemented as ultrasonic welding units.

In terms of a method, the object is achieved by the following steps:

- inserting the composite packages open on top into the rotary machine,
- sterilizing and drying the packages during the rotational transport,
- radial transport of the filled and dried composite packages into the filling unit,
- filling the composite packages,
- radial transport of the filled composite packages to the sealing unit,
- sealing the composite packages, and
- transferring the composite packages out of the filling machine.

According to a first alternative of to the present invention, the sealing units for sealing the filled composite packages are positioned on the rotary machine. Alternatively, however, it is also possible for the filled composite packages to be sealed outside the rotary machine, as is described in greater detail in the following.

Each of the composite packages to be filled is assigned a pocket-like sterile chamber, each of which has an H_2O_2 nozzle and a superheated steam nozzle. In addition, these chambers are followed by a filling outlet and possibly a sealing device for sealing the composite package in sequence radially inward.

The present invention is described in greater detail in the following on the basis of a drawing, which merely illustrates two preferred exemplary embodiments. In the drawing:

Fig. 1 schematically shows a rotary machine according to the present invention in a top view,

Fig. 2 shows an enlarged illustration of a sterile chamber of the rotary machine with the assemblies indicated in a perspective illustration,

Fig. 3 schematically shows the sterile chamber from Fig. 2 in a side view,

Fig. 4 shows the sterile chamber from Fig. 2 in a top view,

Fig. 5 shows a further embodiment of the filling machine according to the present invention in a schematic movement sequence,

Fig. 6 shows the sealing segment of the alternative filling machine in a perspective illustration, and

Fig. 7 shows a sealing unit of the embodiment in Figure 6 in an enlarged illustration.

Fig. 1 schematically shows the design of the filling machine according to the present invention according to a first exemplary embodiment in a top view. In this case, a rotary machine 1, rotatable around an axis of rotation R, has multiple cell-like or pocket-like sterile chambers 2, all of which are provided with treatment assemblies. In the shown and in this respect preferred exemplary embodiment, the rotary machine has sixteen of these assemblies, made of a sterilization unit, a drying unit, a filling unit, and a sealing unit. As is especially obvious from Fig. 2, in this case the sterilization unit essentially includes an H_2O_2 nozzle 3, the drying unit essentially includes a superheated steam nozzle 4, the filling unit essentially includes a filling outlet 5, and the sealing unit essentially includes a sonotrode 6A and an anvil 6B. After filling and sealing of the composite package P, which has been transferred into the rotary machine in the direction of the arrow P1, the discharge then occurs vertically downward via an opening 7, which is only indicated.

The sterile chamber 2 is closed to the outside by a fixed outer wall 8 and is sealed by sealing lips (not shown). This also applies for the upper fixed cover (not shown). A lower bulkhead is not provided, since the H_2O_2-air

mixture must escape downward out of the chamber after the blowing out and before the filling.

The H_2O_2 nozzle and the superheated steam nozzle are connected in series. While, for example, the sterilization 'S' is performed over two "stations", the drying 'T', i.e., blowing out the H_2O_2-air mixture, maybe performed over multiple stations, three in the example.

After the sterilization process, each composite package P is pushed radially inward under the filling outlet 5 using a traveling feeder 9, which is positioned below a radially positioned support rail 10, which also travels. This filling outlet is activated over five stations for the filling 'F' in the illustrated and preferred exemplary embodiment, through which a continuous, low-foam filling of the product is made possible.

Replacing the feeder 9 by a fixed curve 11 implemented corresponding to the motion of the composite package P directed radially inward is also conceivable.

After the filling process, the composite package P preferably moves further inward, so that it arrives underneath the sealing jaws 6A, 6B. The sealing 'V' is now performed over three stations.

The packaging material may still be heated by a steam nozzle 12 during the sealing at the head of the composite package P after the filling, in order to minimize the unavoidable air component in the sealed composite package P through subsequent cooling.

In the last station, the now filled and sealed composite package P is finally displaced once more in the direction toward the axis of rotation R, where the package ears are applied in a known way. The finished composite package is then drawn downward out of the rotary machine 1 through the opening 7 and carried away on a transport band (not shown).

In the preferred example, a rotation around 360° is necessary for a production cycle. With a rotary machine which is dimensioned sufficiently large, doubling to 2 x 180° is also possible, the two supply and outward transfer openings then each lying diametrically opposite one another.

A rotary filling machine has the advantage over the intermittently operating inline filling machines previously used that all processes are performed on a composite package which is stationary in relation to the assemblies. Therefore, more time is obtained for the individual processes, which maybe performed more intensely (sterilization), with low foam (filling process), and more reliably (sealing).

If it is necessary that individual assemblies 3, 4, or 5 must be dipped into the composite package P, this is possible without anything further through a curve controller (cylinder curve) above the rotating units.

For better illustration, the positioning of the individual assemblies inside a sterile chamber 2 is shown

in a side view and a top view, respectively, in Figs. 3 and 4.

Figs. 5, 6, and 7 illustrate a further possible embodiment of the filling machine according to the present invention. In this case, the sealing unit is no longer located on the actual rotary machine, but rather in a housing 13, shaped like an annular segment, which is rotatable by a preset angle around the axis of rotation R. In this case, the sterilization, drying, and filling of the composite packages P is performed on the rotary machine 1 as in the example described above, so that repeated description may be dispensed with.

In Fig. 5, the mode of operation of this alternative of the filling machine according to the present invention is schematically shown in a top view. In the illustrated and in this respect preferred exemplary embodiment, the housing 13 has three sealing stations, which are each provided with sealing units 6A, 6B. The composite packages filled inside the rotary machine 1 are transported radially outward into the housing 13, for this purpose, the housing 13 moves at the same peripheral speed as the rotary machine 1 in the direction of the arrow 14, as illustrated in position ①. It is schematically indicated in position ② that the sealing units 6A, 6B have sealed the composite packages and the sealing of the composite packages was performed while the segment 13 was moved further in the direction of the arrow 15 against the rotation of the rotary machine 1. In the position ③, the sealing tools 6A, 6B are then removed again, the packaging ears are sealed on, and the

rotational direction is reversed again in the direction of the arrow 16. The process then begins again, as shown in position ④, which corresponds to position ①. During the radial pushing of open, already filled composite packages, the finished composite packages are transferred radially outward out of the housing 13 in the direction of the arrows (not shown) and transported further in a known way.

For better understanding, the process of sealing is shown once again enlarged in a perspective view in Figures 6 and 7. In order to now also keep the housing 13, which is shaped like an annular segment, sterile, sterile air is blown into sterile air chambers 18 positioned above the composite package via lines 17, which are only indicated, in order to reliably prevent the penetration of germs into the inside of the package during the sealing. For a better overview, such a sterile air chamber 18 is only shown in the station on the far right in Fig. 6. The enlarged illustration in Fig. 7 shows that the sterile air chamber extends over the entire transport path of the composite package P. Sterile air coming out of the rotary machine 1 simultaneously flows into the inside of the housing 13 in this case, so that there is also excess pressure here.

The present invention is not restricted to the exemplary embodiments shown, but rather two conceivable alternatives are shown here, in which, for longer dwell of a composite package to be filled during its continuous transport, an expedient exploitation of machines with an manageable use of space is possible through the expedient

arrangement and appropriately superimposed rotational and/or translational movement sequences.